



Planetary Defense Coordination Office Update

Planetary Science Advisory Committee meeting

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Washington, DC

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Planetary Defense Coordination Office (PDCO)

The PDCO was established in January 2016 at NASA HQ to manage planetary defense-related activities across NASA and coordinate with both U.S. interagency and international efforts to study and plan response to the asteroid impact hazard.

Mission Statement

Lead national and international efforts to:

- Detect any potential for significant impact of Earth by natural objects
- Appraise the range of potential effects by any possible impact
- Develop strategies to mitigate impact effects on human welfare”

ASSESS

Determine NEO population survey completeness and hazard from NEOs that pose the highest risk

CENTER FOR NEAR-EARTH OBJECT STUDIES (CNEOS)



SEARCH, DETECT & TRACK

Find the natural near-Earth objects – asteroids and comets – and track to determine those whose orbits create an impact hazard to Earth

GROUND & SPACE-BASED OBSERVATORIES,
MINOR PLANET CENTER (MPC),
INTERNATIONAL ASTEROID WARNING NETWORK

PLANETARY DEFENSE

MITIGATE

Demonstrate technologies and techniques to divert or disrupt asteroids in space or inform emergency response activities on the ground

DOUBLE ASTEROID REDIRECTION TEST (DART), FEMA EXERCISES

PLAN & COORDINATE

Work with the U.S. interagency and international collaborations on effective actions for impact threat response

SPACE MISSION PLANNING ADVISORY GROUP,
PLANETARY IMPACT EMERGENCY RESPONSE WG,
PLANETARY DEFENSE IWG

CHARACTERIZE

Determine physical characteristics of NEOs (size, shape, composition, rotation) to understand their natural state

INFRARED TELESCOPE FACILITY,
GOLDSTONE SOLAR SYSTEM RADAR,
NEOWISE



8th IAA Planetary Defense Conference

Hosted by the United Nations Office of Outer Space Affairs, Vienna, Austria

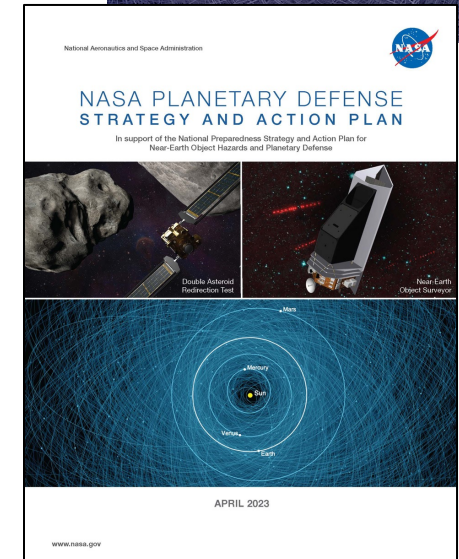
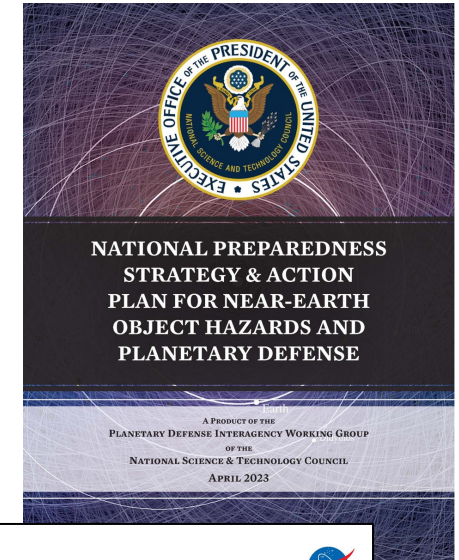
Conference highlights included:

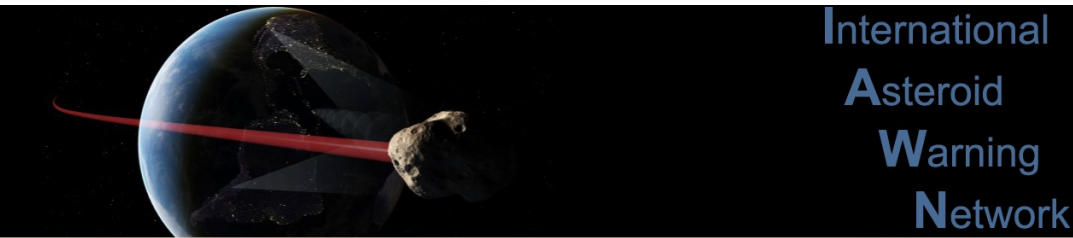
- Asteroid impact tabletop exercise that included representatives from the UN-endorsed International Asteroid Warning Network ([IAWN](#)) and the Space Mission Planning Advisory Group ([SMPAG](#))
- Remarks from Halilu Ahmad Shaba, Director General of the National Space Research and Development Agency of Nigeria, who brought critical Nigerian national and African continent perspective to the tabletop exercise panel of decision makers
- Remarks from Erik Hooks, FEMA Deputy Administrator on how FEMA coordinates response to emergency events and what information would be needed from the Planetary Defense community
- Remarks by other distinguished participants including:
 - UNOOSA's Romana Kofler
 - ESA's Director of Operations Rolf Densing
 - African Union Commission's Meshack Kinyua
 - ISRO's Bulbul Mukherjee
 - UN-SPIDER's Juan Carlos Villagran de Leon
 - U.S. Space Force Chief Scientist Joel Mozer
 - NASA's Assoc. Administrator for Technology, Policy, and Strategy Bhavya Lal
- Remarks from Matt Daniels, Assistant Director of the White House Office of Science and Technology Policy (OSTP) for Space Security & Special Projects on the release of the updated [National Preparedness Strategy and Action Plan for Near-Earth Objects and Planetary Defense](#)



Planetary Defense for the Next Decade (2023 - 2033)

- NASA's DART mission pushed planetary defense into a new era, but despite this achievement, less than half of NEOs capable of catastrophic Earth damage have been found
- To emphasize priorities, the White House OSTP released its [National Preparedness Strategy and Action Plan for NEO Hazards and Planetary Defense](#), outlining six key national goals to address the NEO hazard for the next 10 years
- NASA released a complementary [Planetary Defense Strategy and Action Plan](#) to further specify NASA's – and the PDCO's – role in achieving the national plan's objectives
- **National Plan Strategic Goals (1, 3, and 4 are of “critical focus” for 10-year horizon)**
 1. Enhance NEO detection, tracking, and characterization capabilities
 2. Improve NEO modeling, prediction, and information integration
 3. Develop technologies for NEO reconnaissance, deflection, and disruption missions
 4. Increase international cooperation on NEO preparedness
 5. Strengthen and routinely exercise NEO impact emergency procedures and action protocols
 6. Improve U.S. management of planetary defense through enhanced interagency collaboration
- **NASA Plan Strategic Goals**
 7. Improve organization of NASA's planetary defense activities
 8. Enhance strategic communications related to planetary defense





Observing Campaigns/Exercises

- 2017: Recovery, tracking, and physical characterization of 2012 TC4
- 2019: Physical characterization of (66391) Moshup (binary)
- 2020-2021: Discovery, follow-up, characterization of (99942) Apophis
- 2021: Timing campaign, target 2019 XS
<https://iopscience.iop.org/article/10.3847/PSJ/ac7224>
- 2022: Timing campaign, target 2005 LW3
- Short-warning characterization campaign – 2023 DZ2

2023 DZ2 Characterization Campaign

On March 16, 2023, the Minor Planet Center announced the discovery of near-Earth asteroid 2023 DZ2 by joint Romanian-Spanish team Para-SOL (MPC Code 950).

- Initially estimated to be 40-100 meters in size
- The size, combined with future impact probability, resulted in a Torino Scale 1 hazard rating
- Impact probability rose to 1 in 435* in 2026 before dropping out altogether
- Was to pass within half a Lunar Distance on March 25, 2023

This close approach represented an ideal opportunity for an International Asteroid Warning Network rapid response characterization campaign - an IAWN campaign to exercise the capability of the planetary defense community to collect observations and physically characterize the object on very short notice.

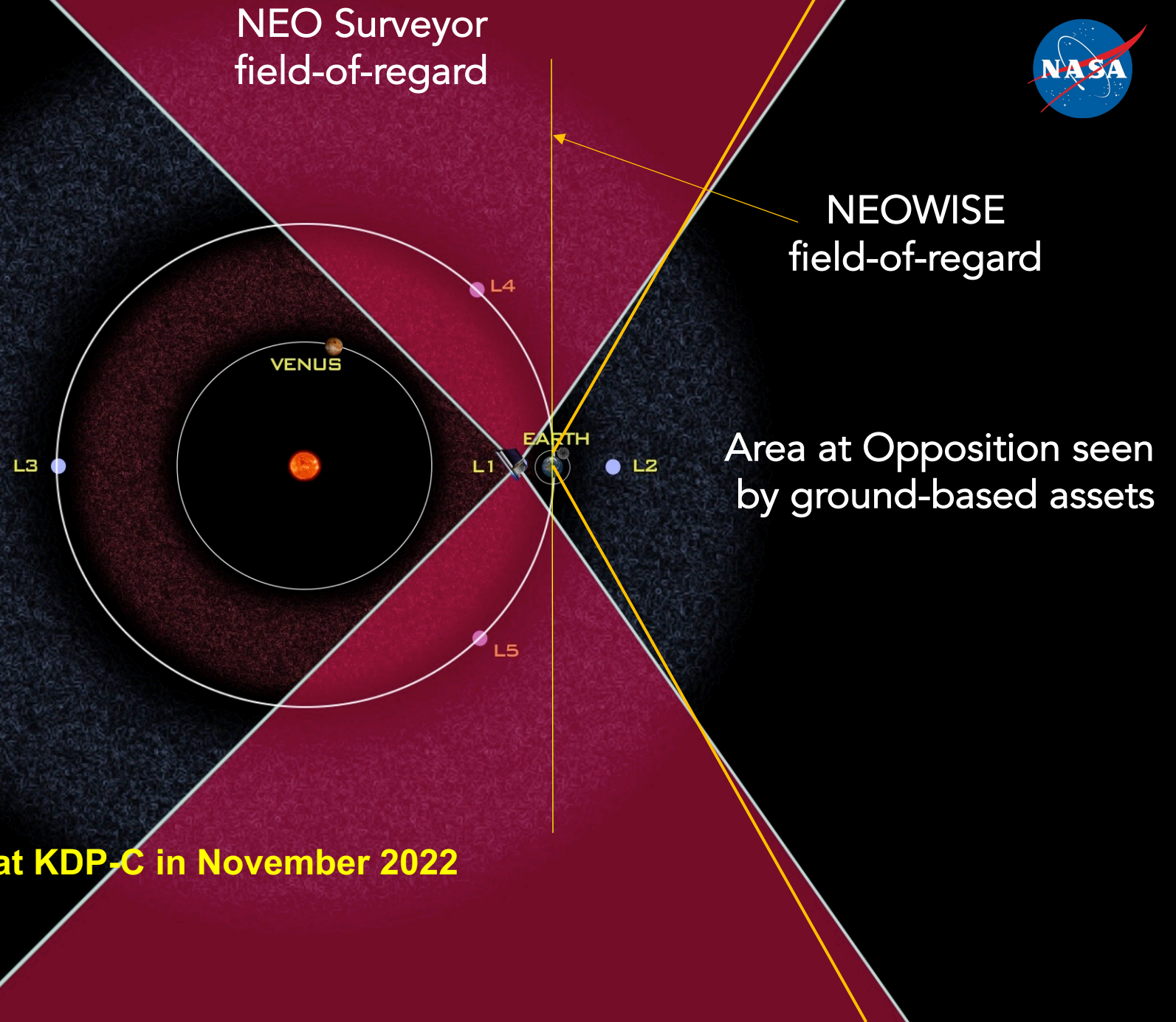
During the short campaign, data were quickly analyzed and results were shared by the photometry, spectroscopy, thermal modeling, and radar working group leads in the virtual campaign meetings

** 1% (1 in 100) is when IAWN would notify SMPAG and UN OOSA, and NASA would use its own NPD 8740.1 notification policy.*

NEO Surveyor



- Space-based infra-red telescope
- Objectives:
 - Find 65% of Potentially Hazardous Asteroids (PHAs) >140 m in 5 years (>90% in 10 years)
 - Estimate object sizes
- **Project approved for Phase C at KDP-C in November 2022**
- **LRD NLT June 2028**



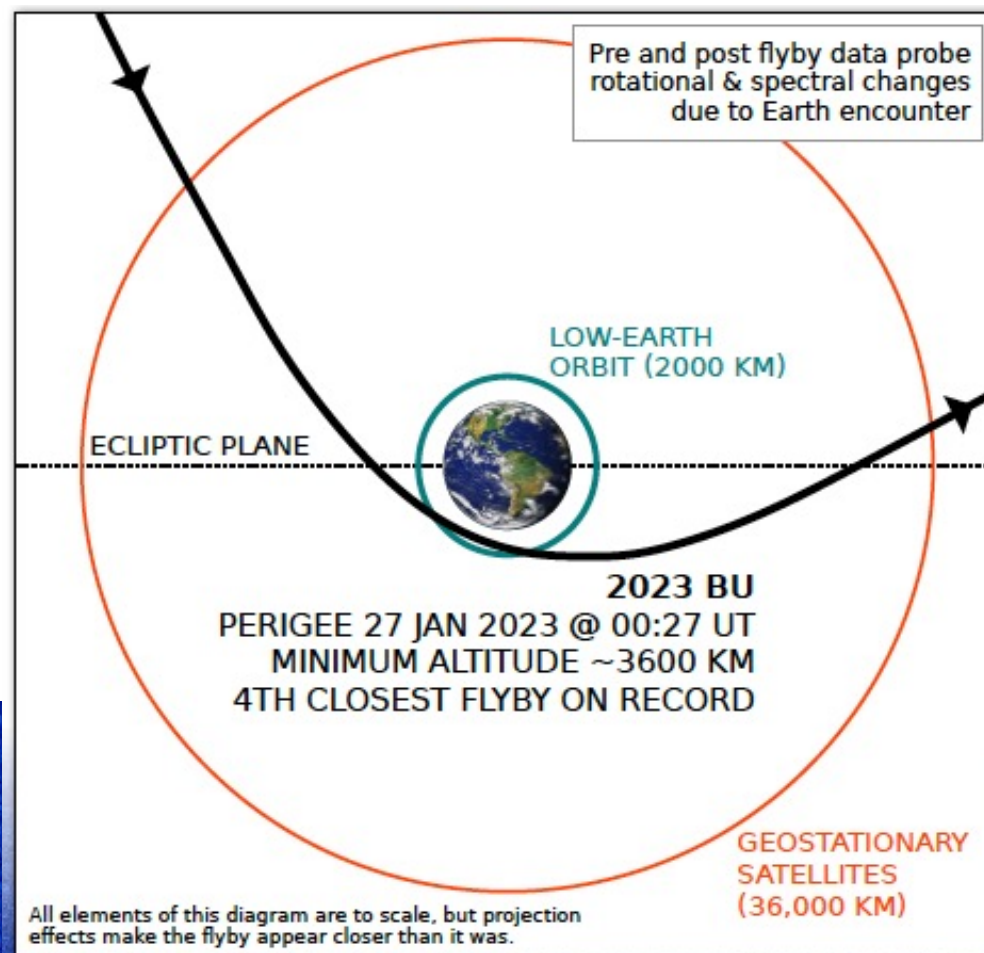
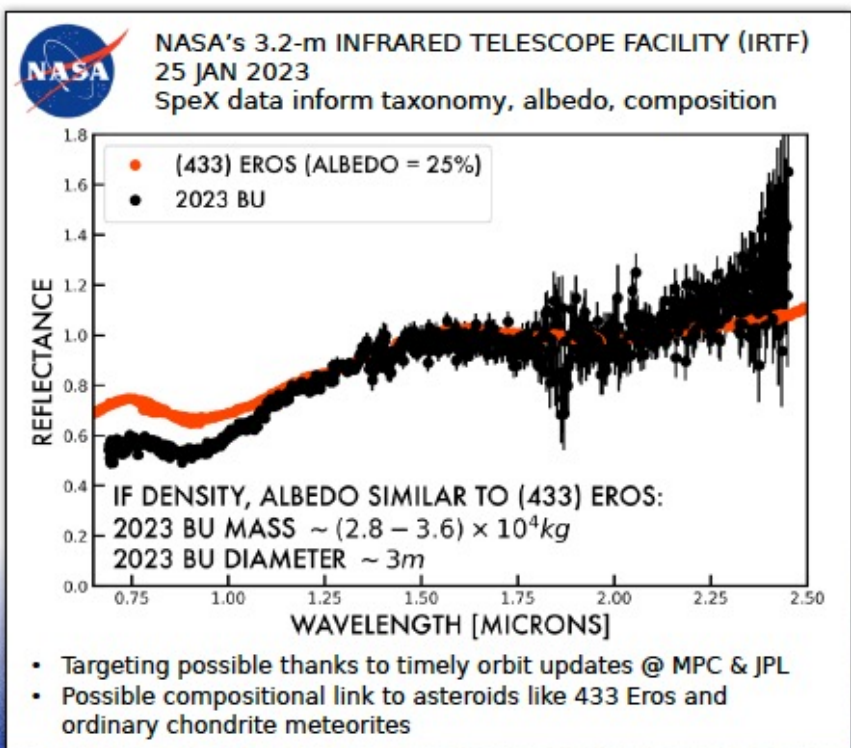
NASA's Infrared Telescope Facility

- NASA IRTF is funded by the Near-Earth Object Observations Program in PSD/PDCO as a primary NEO characterization asset, and continues to be open-access for planetary science and astrophysics in support of NASA missions and Decadal science
- The IRTF Independent Review was briefed to the PAC on Wednesday



Coordinated Target of Opportunity Response to the Earth Close Approach of Asteroid 2023 BU

N. Moskovitz, T. Kareta, B. Burt (Lowell Obs.)
M. Devogèle (Arecibo), D. Farnocchia (JPL), P. Veres (MPC)
B. Bus (IfA), D. Polishook (Weizmann Inst.), R. Binzel (MIT)



4.3-m LOWELL DISCOVERY TELESCOPE

27 JAN 2023

Combination of 31 x 1.2s exposures showing rapid brightness variation, data indicate complex rotation state

NASA's Primary NEO Characterization Assets

NASA's Infrared Telescope Facility



Image credits: UH/IRTF/Connelley

Goldstone Planetary Radar



Interagency Deep Space Radar Study

- The government study is a very preliminary look at potential overlapping needs and technical solutions for deep space/planetary radar across U.S. government agencies that could inform possible interagency partnerships and challenges in pursuing future capabilities
- This government study is completing this month; the intention is to produce a publicly releasable report soon



Update on Arecibo Radar Data Preservation/Archiving

Response to PAC finding

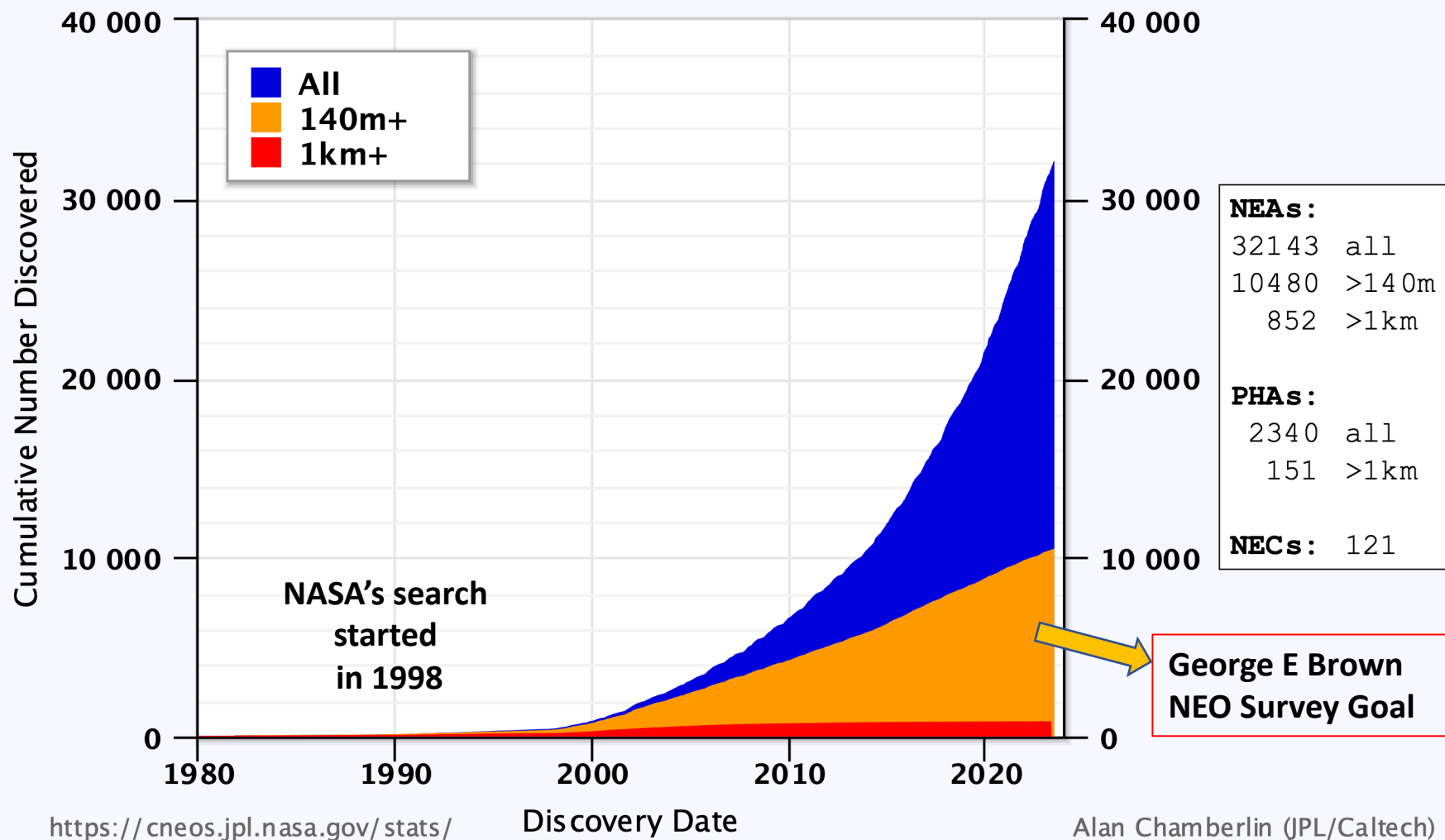
- NASA's Planetary Data System Small Bodies Node (SBN) is in the process of capturing the Arecibo radar data and software copy hosted by Arecibo radar team members at the University of Arizona
- The SBN will deliver those data and software as a pre-archive backup to the NASA Space Science Data Coordinated Archive for preservation
- The Arecibo radar team continues formal PDS archiving of the radar data products with the SBN and the software on a publicly accessible software archive
- NSF has communicated to NASA that the Arecibo radar data and software copy at the Texas Advancing Computing Center will be kept for the foreseeable future, while NASA completes its preservation and formal archiving process

The slide features a dark blue background with abstract, angular blue shapes at the top and bottom edges. The word "Backup" is centered in the middle of the slide in a white, sans-serif font.

Backup

Near-Earth Asteroids Discovered

Most recent discovery: 2023-Jun-12



*Potentially Hazardous Asteroids come within 7.5 million km of Earth orbit

nasa.gov/planetarydefense

All NEAs (as of 2023-Jun-13)

The chart displays the cumulative number of Near Earth Objects (NEOs) discovered by various surveys from 1995 to 2023. The Y-axis represents the 'Number Discovered' (0 to 3000), and the X-axis represents the 'Discovery Date' (1995 to 2023). The surveys contributing to the discoveries are: LINEAR (blue), NEAT (orange), Spacewatch (red), LONEOS (yellow), Catalina (green), Pan-STARRS (magenta), NEOWISE (teal), ATLAS (cyan), Other-US (brown), and Others (grey). The data shows a steady increase in discoveries until around 2021-2022, followed by a sharp decline in 2023.

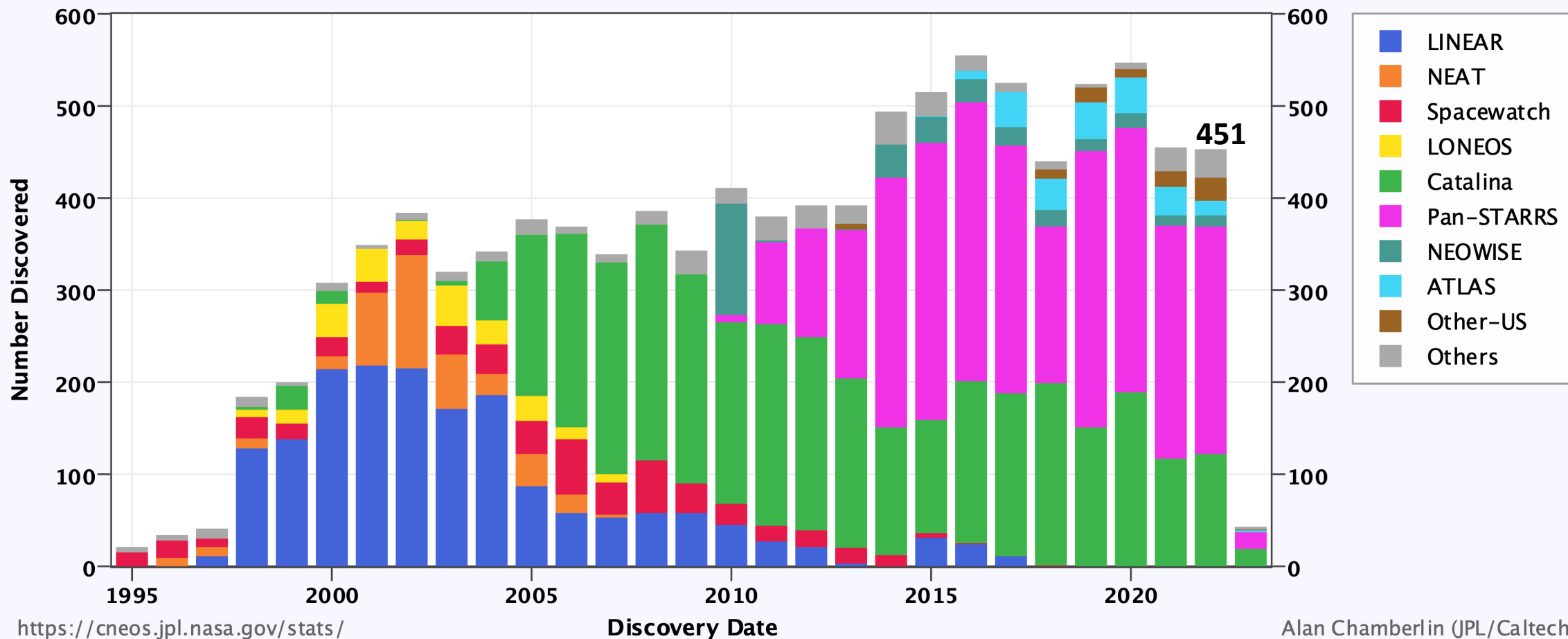
Discovery Date	LINEAR	NEAT	Spacewatch	LONEOS	Catalina	Pan-STARRS	NEOWISE	ATLAS	Other-US	Others
1995	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0	0

<https://cneos.jpl.nasa.gov/stats/>

Alan Chamberlin (JPL/Caltech)

Near-Earth Asteroid Discoveries by Survey

~140m and larger NEAs (as of 2023-Feb-22)



UN Office of Outer Space Affairs Committee on Peaceful Uses of Outer Space

Overview for NEO Threat Response

Last Meetings
7-9 Feb at
UN COPUOS
S&T SC

*Inform in case of
credible threat*

United Nations
COPUOS/OOSA



Parent Government Delegates

Determine Impact time,
location and severity

International Asteroid
Warning Network
(IAWN)
www.iawn.net

Coordinated
by NASA

Observers, analysts, modelers...

Potential deflection
mission plans

Space Missions Planning
Advisory Group
(SMPAG)
www.smpag.net

Chaired
by ESA

Space agencies and offices

Background

IAWN is a worldwide collaboration of asteroid observers and modelers that was recommended by the United Nations

From the IAWN Statement of Intent:

“The intent of the International Asteroid Warning Network (IAWN) is to establish a worldwide effort to detect, track, and physically characterize near-Earth objects (NEOs) to determine those that are potential impact threats to Earth. This network is comprised of a partnership of scientific institutions, observatories, and other interested parties performing observations, orbit computation, modeling, and other scientific research related to the impact potential and effects of asteroids.”

Currently over 55 signatories from over 20 countries